DESCRIPTION

BELLOWS-TYPE COLLAR FOR WASHING MACHINES

[001] The invention relates to a bellows-type collar for washing machines, comprising a machine housing, a lye container that is arranged therein, a cantilevered drum which is rotatably disposed in the lye container, and a frontal loading opening, wherein the bellows-type collar comprises an outer, a central and an inner collar ring and is sealingly fixed to both the machine housing and the lye container in the area of the loading opening, and the inner collar ring is visible through a closure of the loading opening.

[002] Bellows-type collars of this type are disclosed for example in DE 1 707 526 U1 and DE 43 04 009 C2. They bridge a gap between the fixed machine housing and the lye container. During operation of the washing machine, the lye container is subject to vibrations if the drum wobbles as a result of non-uniformly distributed laundry especially during spinning and passes this movement on to the lye container via the common mounting of the drum and lye container. The bellows-type collar must absorb the resulting relative movements between the lye container and machine housing. For this purpose, the collar is made of an elastic material, mostly of rubber and when viewed in a section parallel to an axis of rotation of the drum, has a Z- or S-shaped structure comprising two substantially axially parallel collar rings, an outer and an inner collar ring, and a central collar ring connecting these two. Relative movements between the lye container and the machine housing are absorbed by the collar in that the outer and the inner collar ring can be displaced with respect to one another both in the direction of the axis of rotation and also transversely thereto. In this case, the central collar ring is deflected from its original position and the collar rings are deformed, with the formation of creases in some cases. The creasing runs predominantly parallel to the circumferential line of the loading opening.

[003] The loading opening is generally closed by a transparent container which allows a view into the drum during operation of the washing machine. The viewer's gaze necessarily falls onto the visible part of the bellows-type collar, which is substantially the inner collar ring.

Consequently, any deformation of the collar, especially the inner collar ring, is clearly visible during spinning. This makes an ugly impression and particularly during wobbling movements of the drum and a corresponding deformation of the bellows-type collar, the user can receive the impression that the washing machine is not working correctly and cannot cope with the load of laundry. In addition, noise known as so-called collar flapping caused by the creasing of the inner collar ring occurs in the immediate vicinity of the transparent container which the user can frequently find very disturbing.

[004] It is thus the object of the present invention to reduce the deformation of the bellows-type collar visible to the user and the accompanying noise during the operating state of a washing machine.

[005] This object is achieved according to the invention by assigning an annular stiffening element to the visible inner collar ring, which stiffening element reduces any spreading of deformation forces from the central and outer collar ring on to the inner collar ring.

[006] The invention therefore abandons the idea that during operation of the washing machine, the bellows-type collar must always undergo deformation as a whole to fulfil its function. This is because in an average wobbling movement
where a drum neck of the laundry drum has not yet run against the bellows-type collar, the relative displacement between the edge of the loading opening of the lye container and that of the machine housing, can generally be absorbed by the outer fold of the collar, that is the central and outer collar ring. Thus, the visible inner collar ring of the bellows-type collar is stiffened to such an extent that it shows no creasing at least during an average wobbling movement of the laundry drum. Rather, creasing occurs in the area of the non-visible outer fold of the collar.

[007] Nevertheless, the invention does not go as far as completely stiffening the inner collar ring. It does not exclude the possibility of deformation of the inner collar ring in the event of loading peaks. This occurs in any case when the wobbling movement of the laundry drum is so severe that the drum neck runs against the bellows-type collar or the entire vibrating

system, during spinning for example, executes extraordinarily large relative movements. The collar must naturally yield to this loading in its entirety. Consequently, the inner collar ring cannot be constructed as stiff. Under these conditions, creasing in the area of said inner collar ring should thus not be completely prevented.

[008] In order to meet these requirements, that is on the one hand to counteract creasing when the collar is subjected to average stressing and on the other hand, to allow deformation of the collar in the event of loading peaks, the stiffening element is arranged in a ring shape parallel to the circumferential line of the loading opening. It thus ensures a stiffening effect on the bellows-type collar around the loading opening.

[009] These requirements are satisfied by stiffening elements which supportingly maintain the annular shape of the inner collar ring on the one hand up to a certain force but on the other hand, when this force is exceeded, they yield in an elastic manner. For this purpose, according to an advantageous embodiment of the invention, the stiffening element can consist of a thickened area of the bellows-type collar. This annular thickening can be produced without any major increased expenditure during manufacture of the bellows-type collar. It is not an additional part which needs to be integrated in the collar and thus present no difficulties with regard to undesired interactions between the collar and a separate stiffening element. In addition, its dimensions can be very variable and it can be simply adapted according to the requirement by varying its dimensions.

[010] According to an alternative embodiment of the invention, a flexible metal ring can be used as the stiffening element, this being vulcanised on or in the rubber of the bellows-type collar. This variant is to be preferred when the stiffening element can only have a small cross-section for reasons of space.

[011] Finally, the flexible metal ring can additionally be arranged on or in the annular thickened area and thus the advantages of both variants of a stiffening element can be combined in a third.

[012] The stiffening element is expected to have the best effect when it acts as far as possible on the entire visible area of the bellows-type collar, that is on the entire inner collar ring. Since the bellows-type collar and with this the inner collar ring is fixed on the edge of the loading opening of the machine housing on the housing side, an advantageous further development of the invention

consists in the stiffening element being disposed in the area of the inner collar ring which lies closest to the drum neck of the drum. The inner collar ring thus extends between the fixing of the bellows-type collar on the machine housing on the one hand and the stiffening element close to the drum neck on the other hand. Consequently, it extends between two counter-bearings and substantially covers the visible area of the sleeve. The stiffening element is advantageously disposed on the non-visible side of the inner collar ring in order not to impair the viewing surface of the inner collar ring.

[013] The arrangement of the stiffening element close to the drum neck has a further advantage: since the stiffening element is constructed as a thickened area, that is, as a concentration of material, in the bellows-type collar and is disposed at the location of the collar which can be subjected to severe stress during operation when the rotating drum neck is starting up, the stiffening element at the same time prevents the collar against chafing at this point and prevents any wear-induced lack of sealing.

[014] With the stiffening of the inner collar sleeve, the crease formation moves into the outer fold of the bellows-type collar as desired. This effect is further promoted by encouraging crease formation in this area. According to an advantageous embodiment of the invention, an articulated section is disposed in the covered section of the bellows-type collar which promotes deformation of the bellow-type collar in this area. The effect of the stiffening element is thus increased and ensures that the visible area is reliably protected from crease formation under average stresses.

[015] A section of the bellows-type collar acts as an articulated joint as soon as it allows deformation before its surroundings. In the present case, this can be formed most simply by a particular shaping in the outer fold. According to the invention, this is achieved by the

articulated section being formed by a thinner-material area between two thicker-material, preferably thickened areas of the bellows-type collar. In this embodiment of the articulated section, the dimensioning and manufacture are particularly simple. The articulated section can easily be integrated into the bellows-type collar and can be arranged at the manufacturers at almost any position of the outer fold.

[016] According to its function, the articulated section defines that length of the bellows-type collar between the edge of the lye container and that of the machine housing which is available for deformation by creasing. In order to largely avoid a non-uniform load distribution and unnecessary stressing of the material caused thereby, the area of the collar capable of being deformed under average loading should be as long as possible. Consequently, it is an advantageous further development of the invention if the articulated section in the covered section of the bellows-type collar directly adjoins the stiffening element. The largest possible length of the collar, namely the entire length of the outer fold is thus available for deformation under average loading. Consequently, the dimensions need not differ from those of conventional bellows-type collars so that the material and manufacturing costs do not differ significantly from those of known collars.

[017] The principle of the invention is explained in detail hereinafter with reference to an exemplary embodiment shown in the drawings. In the figures:

[018] Figs. 1 and 1a show a schematic section through a washing machine according to the prior art and

[019] Fig. 2 shows a section view through a section of a washing machine with an embodiment of a bellows-type collar according to the invention.

[020] As shown in Fig. 1, a washing machine usually comprises a machine housing 1 in which a lye container 2 is located which contains a horizontal washing and spinning drum 3. The lye container 2 is connected via a sump to a discharge pump 4 which pumps away washing solution from the lye container 2 as required. The lye container 2 and the drum 3 are mounted

with respect to one another at a front side of the drum 3 in a bearing 5. Whereas the lye container 2 is not held rotatably there, the drum 3 is mounted so that it can rotate about at least one approximately horizontal axis of rotation D and so that it is cantilevered. The bearing 5 in turn is held in a vertical plane mounted perpendicularly to the axis of rotation D by radially stressed tension springs, not shown in the machine housing 1.

[021] On the front side opposite to the bearing 5 of the drum 3, the washing machine has a loading opening 6 which passes through the machine housing 1, the lye container 2 and the drum 3 and allows the washing machine to be loaded. The loading opening 6 is closed by a door-like pivotable bull's eye, hinged on one side, which contains a window 7 of glass or plastic and thus allows a view into the drum 3 during operation of the washing machine.

[022] The washing machine is sealed in the area of the loading opening 6 by a bellows-type collar 8 which sealingly bridges a distance A between the machine housing 1 and the lye container 2 at the respective edge to the loading opening 6 as well as the machine housing 1 and the lye container 2 and runs around the circumference of the loading opening 6.

[023] During operation of the washing machine, especially during spinning, the drum 3 together with the lye container 2 undergoes considerable vibrations whereas the machine housing 1 is stationary. The vibrations affect the lye container 2 because it and the drum 3 are commonly mounted in the bearing 5. The collar 8 must compensate for this relative movement between the machine housing 1 and the lye container 2. The bellows-type collar 8 is adapted to this purpose on the one hand with regard to its material and on the other hand, with regard to its shape. This bellows-type collar firstly consists of an elastic material, preferably of rubber, and secondly has a Z-shaped cross-section with a bellows 9 when considered in a cross-section parallel to the axis of rotation. The bellows 9 also allows permanently large relative movements between the machine housing 1 and the lye container 2 without causing any damaging expansion of the collar 8. It comprises an inner collar ring 10 visible through the glass window 7 and a concealed outer fold. The outer fold consists of a central collar ring 11 and an outer collar ring 12. The outer collar ring 12 runs substantially parallel to the inner collar ring 10 whilst the central collar ring 11, which joins the outer collar

ring 12 to the inner collar ring 10 in the Z-shaped bellows, is inclined theretowards at an angle.

[024] If the drum 3 is non-uniformly loaded so that the laundry load in the drum 3 creates an imbalance, the drum 3 starts to vibrate during operation as a result. The vibrations are transmitted via the common mounting 5 of the drum 3 and the lye container 2 to said container. The lye container 2 undergoes relative movements with respect to the machine housing 1 whereby the distance A becomes larger and smaller in some cases in rapid succession.

[025] These movements must be absorbed by the bellows-type collar 8. They result in a displacement of the two collar rings 10, 12 with respect to one another, not only horizontally but also vertically. Since these rings are fixed at their edges facing away from one another on the machine housing 1 or on the lye container 2, a change in length of the distance a is compensated by a twist of the central collar ring 11. Consequently, the respective free edges of the collar rings 10, 12 become deformed with the twisting.

[026] This deformation of the bellows-type collar 9 does not necessarily run uniformly when viewed along the annular loading opening 6. This is because the lye container 2 and the drum 3 firstly vibrate as a result of the spring-mounted suspension of the bearing 5 jointly in the direction of the axis of rotation D whereby the distance A increases or decreases in the same direction on all sides around the loading opening 6. This movement can become so strong that the drum 3 with its drum neck 13 runs against the bellows-type collar 9, especially at the inner collar ring 10 with which it lies at approximately the same height. The lye container 2 and the drum 3 also wobble together with the mounting 5 as the centre point of rotation in a suspension, not shown, of the vibrating unit in the housing 1 so that at the location of the loading opening the distance A increases whereas at another location, for example at an opposite location with respect to the axis of rotation D, it decreases.

[027] These partly superposed movements of the lye container 2 with respect to the fixed machine housing 1 result in the same deformations of the bellows-type collar 8. In addition to

the deformations of the individual collar rings 10, 11, 12 which have already been described, they also result in creases which can be observed from outside through the glass window 7.

[028] Figure 2 is a sectional view through a section of a washing machine with an embodiment of a bellows-type collar 20 according to the invention. This is composed of an externally visible inner collar ring 21 and a non-visible outer fold comprising a central collar ring 22 and an outer collar ring 23. The central collar ring 22 joins the outer 23 and the inner collar ring 21 along their free edges 24, 25. Like known collars, the collar 20 is fixed by means of a fixed edge 26 of the inner collar ring 21 on a machine housing 1 and by means of a fixed edge 27 of the outer collar ring 25 on a lye container 2. Located in the lye container 2 is a conventional drum 3 whose drum neck 13 is located in the vicinity of the free edge 24 of the inner collar ring 21.

[029] A thickened area in the form of a nose 28 directed towards the drum neck 13 is formed at the free edge 24 at the transition of the inner collar ring 21 to the central collar ring 22. At the central collar ring 22 this thickened area goes over into an articulated section 29 formed by a material tapering of the cross-section of the central collar ring 22. Adjacent thereto is a bead 30 which is embodied as a material thickening.

[030] The nose 28 forms a stiffening element on the inner collar ring 21 which encloses it between itself and its fixing on the machine housing 1. This nose runs uniformly on the inner collar ring 21 along the circumferential line of the loading opening and is constructed as part of the free edge 24. It thus forms an annular stiffening of the free edge 24. This nose expands on the side of the inner collar ring 21 facing away from the viewing surface. Thus, it cannot easily be identified by a user, whereby the bellows-type collar 20 imparts a visually conventional impression to the user.

[031] The sequence of articulated section 29 and bead 30 adjoining the nose 28 is located on the central collar ring 22 and therefore also in an area which is concealed towards the user. They also run uniformly along the entire circumferential line of the loading opening. The articulated section 29 is a particularly resilient area of the outer fold which is thus located in

an area in the outer fold protected from mechanical stressing by rotating parts of the washing machine or by items of laundry and located between the nose 28 and the bead 30.

[032] As a result of their material thickness, both the nose 28 and the bead 30 on the other hand offer resistance to any deformation force. The nose 28, the articulated section 29 and the bead 30 together therefore specifically define an area in the outer fold which undergoes deformation in the event of a force applied to the bellows-type collar 20 by the lye container 2 whereas the remaining areas initially remain largely unaffected thereby. As the action of the force increases, as a result of its cross-sectional shape and its greater length compared with the inner collar ring 21, initially the outer fold becomes deformed, whereby the inner collar ring 23 buckles against the central collar ring 22 along the free edge 25 and the outer 23 and/or the central collar ring 22 become creased. The nose 28, which counteracts any creasing in a stiffening manner, particularly protects the inner collar ring 21 from any creasing thereby induced.

[033] Only in the event of a loading peak when the lye container 2 is deflected so far that the drum neck 13 runs against the free edge 24 and forces this towards the machine housing 1, does the inner collar ring 21 undergo compression, which result in corrugation of its viewing surface. If the drum neck 13 runs against the free edge 24 as a result of the wobbling movement of the lye container 2, so that the drum neck 13 only comes in contact with the free edge 24 in a partial area of its circumference, the annular nose 28 yields in the corresponding area as a result of its elastic deformability and allows the bellows-like collar 20 to move away and thereby allows the inner collar ring 21 to undergo deformation.

[034] The stiffening effect can also be achieved by vulcanising a flexible metal ring on or in the thickened areas 28 and 30 described, either in each or as desired. This can be provided additionally to thickening of the material.

[035] The free edge 24 is exposed to considerable wear as a result of the rotating drum neck 13 running against it. If the nose 28 counteracts a starting force of the drum 13 in a stiffening manner, the wear is increased. In order to avoid any wear-induced lack of sealing of the

bellows-type collar 20, the dimensions of the nose 28 should be additionally designed for abrasion during the normal lifetime of the washing machine.

[036] Reference list

1. Machine housing
2. Lye container
3. Washing and spinning drum
4. Discharge pump
5. Bearing of lye container 2 and drum 3
6. Loading opening
7. Glass window
8. Collar
9. Bellows of collar 8
10. Inner collar ring
11. Central collar ring
12. Outer collar ring
13. Drum neck
1. Bellows-type collar
2. Inner collar ring
3. Central collar ring
4. Outer collar ring
5. Free edge of inner collar ring 21
6. Free edge of outer collar ring 23
7. Fixed edge of inner collar ring 21
8. Fixed edge of outer collar ring 23
9. Nose
10. Articulated section
11. Bead

[037] A Distance between machine housing 1 and lye container 2

[038] D Axis of rotation of drum 3

[039]